Session 1

Giant Steps and Baby Steps

Materials

- Index cards or stick-on notes
- Student Sheet 1 (1 per student, homework)
- Family letter (1 per student)

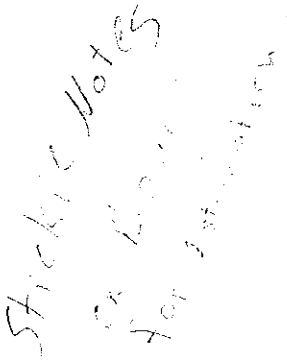
What Happens

Students participate in familiar activities that link measurement to physical movement. They count their baby steps and giant steps as they measure distances in the classroom. As the students collect data and compare their results, they begin to notice and analyze the numerical differences that are produced when they use units of different sizes. Their work focuses on:

- estimating length
- using a nonstandard unit to measure distance
- comparing the effects of measurement using units of different sizes
- collecting and analyzing data

Activity

Estimating Distance in Giant Steps



This activity assumes that you have already introduced the game Giant Steps (described on p. 7), either during class time or recess. You should also know how to record data on a line plot, as explained in the Teacher Note on p. 8. Start class by reminding students about the game.

Remember when we played Giant Steps? Today we're going to estimate and then count distances in the room in giant steps.

Select a student to be the giant. The giant is to stand at the front of the classroom, then take two giant steps and freeze. Ask the other students to estimate the whole length of the classroom in those giant steps.

Make a picture in your head and try to imagine how many of Ricardo's giant steps it would take to get to the far wall.

Write the estimates on the board; then ask the giant to pace three more giant steps, and record any revision of the students' estimates. Next, as the giant paces the whole length of the room, have the students count out loud and record the answer.

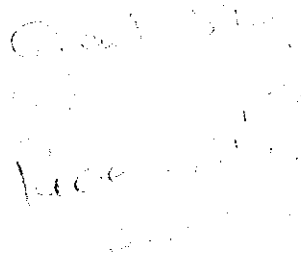
You could each measure the length of the room in your own giant steps. Will all your answers be the same? What do you think?

Allow time for students to talk about whether they think there will be any variation in their results. Third graders have a wide range of theories about how and why measurement results might vary.

Measuring the Length of the Classroom Establish student pairs that will pace the length of the classroom in giant steps. While one partner paces, the other counts. Students then switch roles. Ask students to record their results on the board. They may look like this:

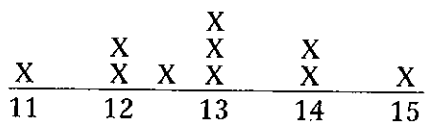
13 15 12 13 14 13

11 12 14 12 $\frac{1}{2}$



Look at the numbers on the board. Did everyone get the same results? Is that surprising? Why or why not?

Making Line Plots Make a line plot on the board to show the results of the pairs' pacing off the room. Draw a number line, label the points to include the smallest and largest numbers of giant steps, and show students how to make X's, check marks, or other symbols to record their data along the line.



Why do you get different results? Can you think of some reasons?

Allow time for students to discuss the variation in results (which will surprise some students more than others). There is much room here for theory-building. For all the theories that are suggested, ask students for their reasons and evidence. Support their good thinking. Some of your students will have an easy time seeing that the size of a student's step makes a difference in numerical results; others won't. Inverse relationships—the smaller the pace, the bigger the number of paces—are sometimes hard to grasp, hold on to, and use.

Activity

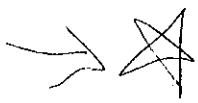
Measuring in Baby Steps

Now you are going to measure the same distance—the length of the room—but you'll use baby steps instead of giant steps. Do you think you'll get different results?

Allow a full discussion of students' predictions here, and when you think they're ready, ask someone to demonstrate baby steps.

Imagine, now, how many little steps like that it takes to get to the other wall. Try to imagine the baby steps in a straight path across the room. How many will it take?

Record students' predictions, then pair up students to pace the room in baby steps and count how many they take. When they have finished, have them write their results on index cards or stick-on notes, and then enter the data on a line plot.



Note: Save both the giant step and baby step data gathered in Session 1 for use in Session 2. Students will be comparing today's results with the results of their next class activity.

Session 1 Follow-Up

Homework

Giant Steps and Baby Steps Student Sheet 1, Giant Steps and Baby Steps, encourages students to measure using giant steps or baby steps in their home environments. Send home the family letter or *Investigations* at Home with this sheet.

❖ **Tip for the Linguistically Diverse Classroom** For the second half of the activity on Student Sheet 1, give students the option of writing the starting and ending points in their native languages, or drawing simple sketches of where they began and ended.

Playing the Giant Steps Game

Teacher Note

This game (also called Mother, May I?) may be one your students know already. It usually involves 6–12 players. Optimal size is a group of about 10. You may want to divide your class and take turns playing—or if space allows, have two or three groups playing at once.

One player is the caller, who gives directions. The caller stands on an imaginary line facing the other players; they stand in a row about 15 to 20 feet away and move toward the caller as directed. The object of the game is to cross the line on which the caller stands. The first person over that line becomes the next caller.

The caller gives directions to each player in turn, such as "Take 5 giant steps" or "Take 7 baby steps," typically giving different instructions to each player. After hearing the directions, the player to whom they were directed must ask, "May I?" The caller then gives permission to perform the action with the words, "You may." Gradually, players advance toward the caller. A player who forgets to ask "May I?" must go back to the starting line.

In some versions of the game, the player proposes a move ("May I take 6 baby steps?"), which the caller can either allow ("Yes, you may") or disallow with a substitution ("No, but you may take 6 banana twirls"). The repertoire of possible moves includes:

- giant steps (the longest steps possible for the individual)
- baby steps (heel-to-toe steps)
- banana twirls (putting hand on head, stepping forward, and turning 360° simultaneously)
- bunny hops (hopping with both feet at once)
- lamp post (lying on the ground with feet marking current position—player reaches as far forward as possible, and stands at that point)
- duck steps (squatting, holding onto ankles, walking forward, quacking and flapping arms)
- anything else your students know (it will vary from one region to another)

Much of the game revolves around the caller imagining how many steps it will take to reach the finish line—and, of course, playing favorites about who will cross the line first to become the next caller. For your purposes, the point of the game is that students practice visualizing distances and use a variety of steps of different lengths.

As a variation, you might work specifically on visualizing measures of distance. Set yourself up as the caller and have two or three students stand in a row about 6 feet away. As you give directions (e.g., "Take 4 giant steps" or "Take 3 banana twirls"), ask the rest of the class to visualize whether the students will or will not reach you at the finish line with that move.

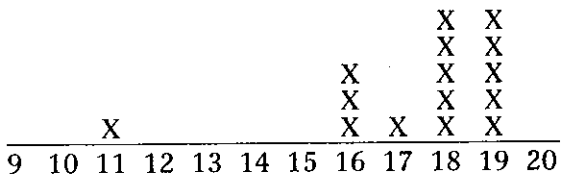
Get P.E. Teacher
To play with Students.

Teacher Note

Line Plot: A Quick Way to Show the Shape of the Data

An important part of statistics is organizing and representing data so that they are easy to see and describe. A *line plot* is one quick way to organize numerical data. It clearly shows the range of the data and how the data are distributed over that range. Line plots work especially well for numerical data with a small range.

A line plot is often used as a working graph during data analysis. As a working graph, it is an organizing tool we can use as we begin work with a data set, not a careful, formal picture we use to present the data to someone else. Therefore, it need not include a title, labels, or a vertical axis. A line plot can be simply a sketch showing the values of the data along a horizontal axis and X's to mark the frequency of those values in the data set. For example, if 15 students have just collected data on the number of paces it takes to walk the length of the classroom, a line plot showing these data might look like the one below.



From this display, we can quickly see that two-thirds of the students took either 18 or 19 paces. Although the *range* is from 11 to 19, the *interval* in which most data fall is from 16 to 19. The *outlier*, at 11, appears to be an unusual value, separated by a considerable gap from the rest of the data. (These are terms that you will use with students as the need arises—introducing them informally in the context of discussing their data, rather than with formal definitions.)

One advantage of a line plot is that we can record each piece of data directly as we collect it. To set up a line plot, start with an initial guess from students about what the range of the data is likely to be: What do you think the lowest number should be? How high should we go? Leave some room on each end of the line plot so that you can lengthen the line later if the range includes lower or higher values than you expected.

By quickly sketching data in line plots on the chalkboard, you provide a model of how such plots can provide a quick, clear picture of the shape of the data.